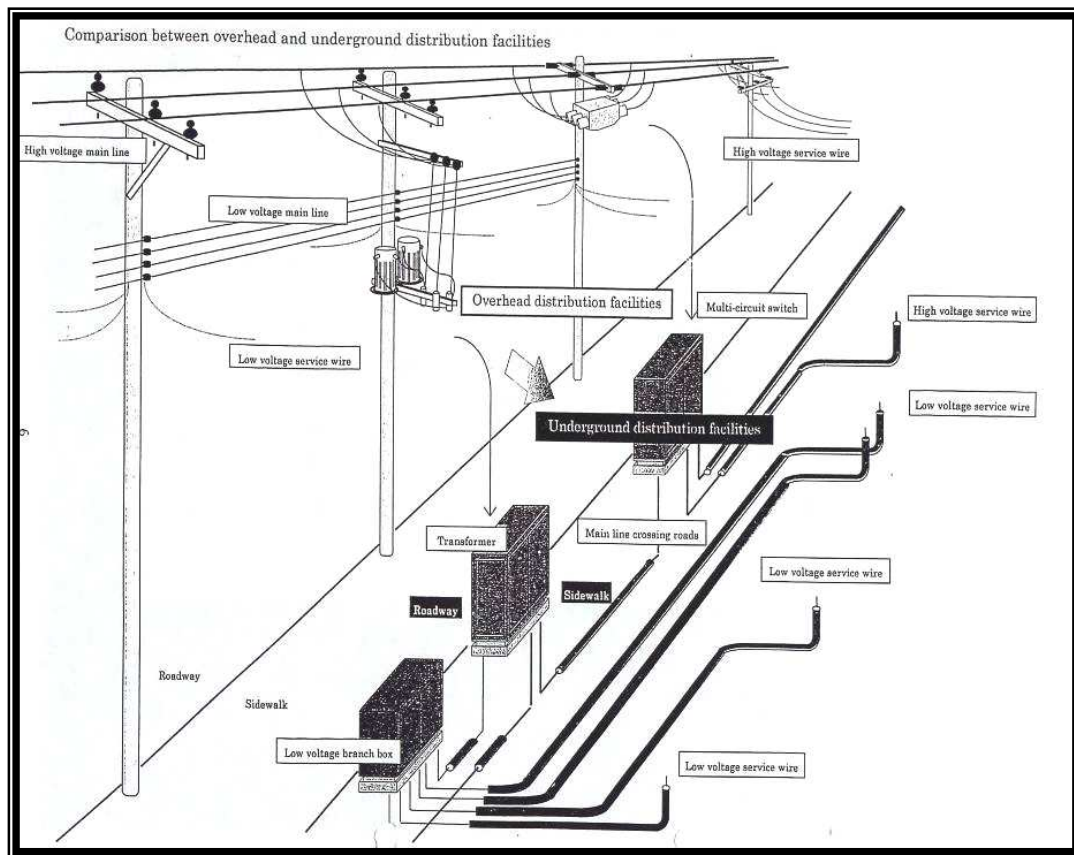




METROPOLITAN ELECTRICITY AUTHORITY

THE REPLACEMENT OF OVERHEAD LINE BY UNDERGROUND CABLE SYSTEM PLAN 2008 - 2013



POWER SYSTEM PLANNING DEPARTMENT

Preface

Metropolitan Electricity Authority (MEA) is a state enterprise, established under the Metropolitan Electricity Authority Act, B.E. 2501. It is responsible for power distribution to the consumers in Bangkok Metropolis, Nonthaburi and Samut Prakarn provinces, covering an area of 3,192 sq.km. In view of its past performance, MEA has avail power distribution system improvement and expansion plan as its major plan. Currently, nine power distribution system improvement and expansion plans have already been implemented. At the end of fiscal year 2006, MEA could supply maximum power demand of 7,379 Megawatt for 2.63 million customers in its service area.

To serve the increasing power demand and reinforce the reliability of the power system, the Tenth Power Distribution System Improvement and Expansion Plan, FY 2008-2011 has been prepared. Additionally, MEA has prepared the Replacement of Overhead Line by Underground Cable System Plan, FY 2008-2013 for the key areas in city center. The Plan consists of 3 projects, namely Patumwan, Chitralada and Payatai Project, which is the additional project of the former projects; Rama 3 Project and Nonsee Project, totaling of 25.2 km. The objectives of the Plan are to enhance nice landscape, reinforce the reliability of the existing power system, as well as serve the increasing power demand. The details of the Plan are provided herein.

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The Replacement of Overhead Line by Underground Cable System Plan

Fiscal Year 2008 - 2013

1. Introduction

At present, Metropolitan Electricity Authority (MEA)'s service area is mainly supplied power by the overhead line system except on Silom Road, Patumwan and Chitralada areas, which are supplied by the underground cable system. Additionally, the areas of Phaholyothin, Payatai and Sukhumvit Road have been in the improvement process to be supplied by the underground cable system. However, the total amount of the areas supplied by the underground cable system is only about 1 percent of MEA's whole service areas.

Although the underground cable supply system requires high investment cost and has more difficulties in construction method, operation and maintenance, as well as the connectivity to the users than the overhead line system, it provides greater reliability of power supply system, safety and environment. Therefore, it is favorable in the developing countries' urban areas. In Thailand, the Government and the agencies, e.g. Ministry of Finance, Ministry of Energy, Office of the National Economic and Social Development Board (NESDB), and Office of Transport and Traffic Policy and Planning, approved MEA's expansion of the underground cable supply system areas to enhance nice landscape and surroundings. MEA, however, has to implement the Plan with its own finance and human resources. Moreover, the impact to the traffic should be highly concerned. The implementation of the Plan conforms to MEA's strategic plan. Hence, it enables MEA's operation on core business to be more secure and with high quality. To do so, MEA has prepared the Replacement of Overhead Line by Underground Cable System Plan, FY 2008-2013, consisting of 3 projects. The projects are namely Patumwan, Chitralada and Payatai, which is the continuation of the former Plan, Rama 3, Project and Nonsee Project. The total length is approximately 25.2 km. The total areas cover 2.52 sq.km. The scope of area according to the Plan is shown in figure 1-1.

■ Completed project (16.2 km), consisting of:

Silom, Chitralada and Pathumwan

■ Projects according to the Ninth Plan is during implementation (24.4 km), consisting of Sukhumvit, Phaholyothin and Payatai

■ Projects according to the Tenth Plan (25.2 km), consisting of:

- Patumwan, Chitralada and Payatai

Additional Project (6.0 km)

- Rama 3 Project (10.9 km)

- Nonsee Project (8.3 km)

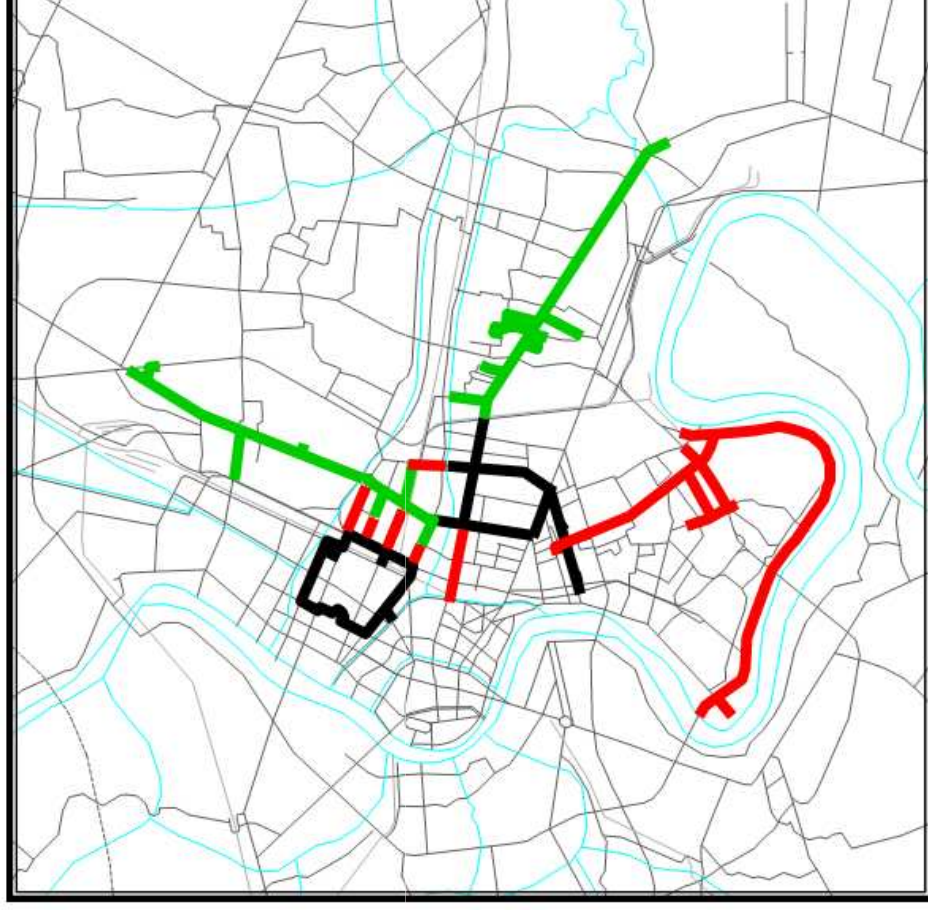


Figure 1-1 : Scope area according to the Replacement of Overhead line by Underground Cable System Plan, FY 2008-2013

2. Objectives

- 2.1 To enhance a nice landscape
- 2.2 To reinforce the reliability of the existing power system
- 2.3 To provide services in response to the increasing power demand

3. Scope and Target

MEA formulated 3 projects under the Replacement of Overhead Line by Underground Cable System Plan, FY 2008- 2013. The scope and target of the Plan are as follows:

1) Patumwan, Chitralada and Payatai Additional Project

In order to interrelate the area of underground cable between Patumwan Project, Chitralada Project and Payatai Project, MEA set additional target area of underground cable route under Rama 1 Road, Yothee Road, Sri Ayudhaya Road, Petchaburi Road and Ratvithee Road, covering total length of 6.0 kilometers and the area of 0.60 sq.km. Consequently, MEA formulated the Replacement of Overhead Line by Underground Cable System Plan, covering the following areas:

- Rama 1 Road (from Payatai Road to Kasatsuk bridge)
- Yothee Road (from Soi Senarak to Rama 6 Road)
- Sri Ayudhaya Road (from Payatai Road to Rama 6 Road)
- Petchaburi Road (from Banthadthong Road to Rama 6 Road)
- Ratvithee Road (from the Victory Monument to Rama 6 Road)
- Ratchaparob Road (from Sri Ayudhaya Road to Ratchadamri Road)

The details of scope area are shown in figure 3-1.

2) Rama 3 Project

The project starts from Rama3 Road (from the Parallel Road to Chalerm Mahanakorn Expressway at the northern side of Nanglinchi Road to the approach of Krung Thep Bridge (Pra Nakorn side), and Soi Yaek Thanontok, covering the total length of 10.9 km and the area of 1.09 sq.km. The mentioned route is a significant transportation way of Bangkok and comprises of many power users in business sector, office buildings, department store and

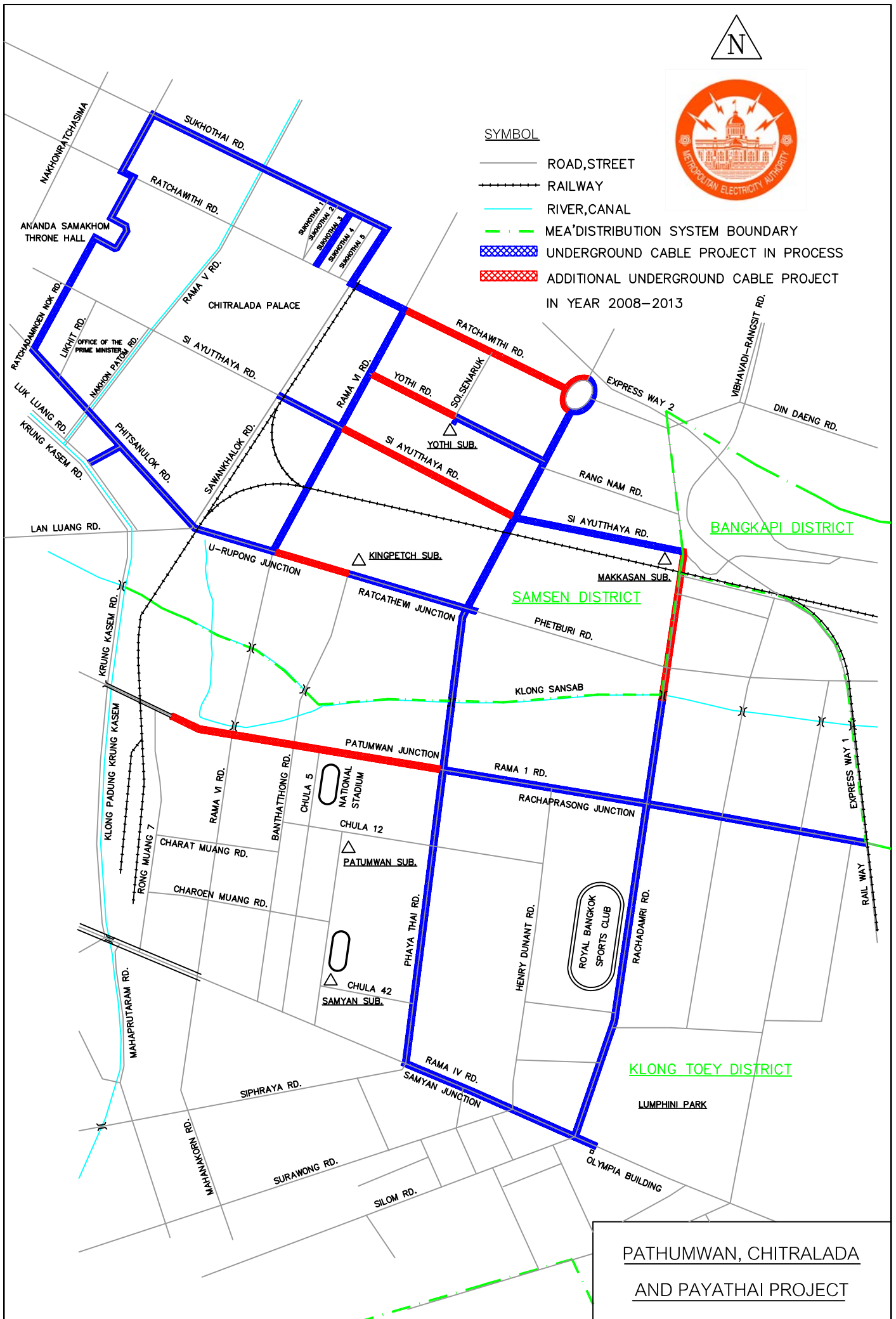


FIGURE 3-1 MAP OF TARGET AREA OF PATHUMWAN, CHITRALADA AND PAYATHAI ADDITIONAL PROJECT

residential customers. MEA, therefore, prepared the Replacement of Overhead Line by Underground Cable System Plan, covering the following areas:

- Rama 3 Road (within range of the Parallel Road to Chalerms Mahanakorn Expressway at the northern side of Nanglinchi Road, to the approach of Bangkok Bridge (Pra Nakorn side))
- Soi Yaek Thanontok

The details of scope area are shown in figure 3-2.

3) Nonsee Project

The Project starts from Narathiwat Ratchanakarin Road (ranging from Rama 3 Road to Surawong Road and the nearby area). The total length is 8.3 km covering the total area of 0.83 sq.km. This area is one of the key routes of Bangkok, consisting of many power users in business sector and residences. Hence, MEA has set up the Replacement of Overhead Line by Underground Cable System Plan to cover the following areas:

- Narathiwat Ratchanakarin Road, ranging from Rama 3 Road to Surawong Road and Soi Anumarn
- Soi Sawan Arom (Soi Sathupradit 19), ranging from Sathupradit Road to Narathiwat Ratchanakarin Road
- The Parallel Road to Chalerms Mahanakorn Expressway, ranging from Sathupradit Road to Nanglinchi Road
- Sathupradit Road, ranging from the Parallel Road to Chalerms Mahanakorn Expressway to Soi Sathupradit 12

The details of scope area are shown in figure 3-3.

Additionally, the target and quantity of works of the 3 projects of the Replacement of Overhead Line by Underground Cable System Plan are provided in Table 3-1.

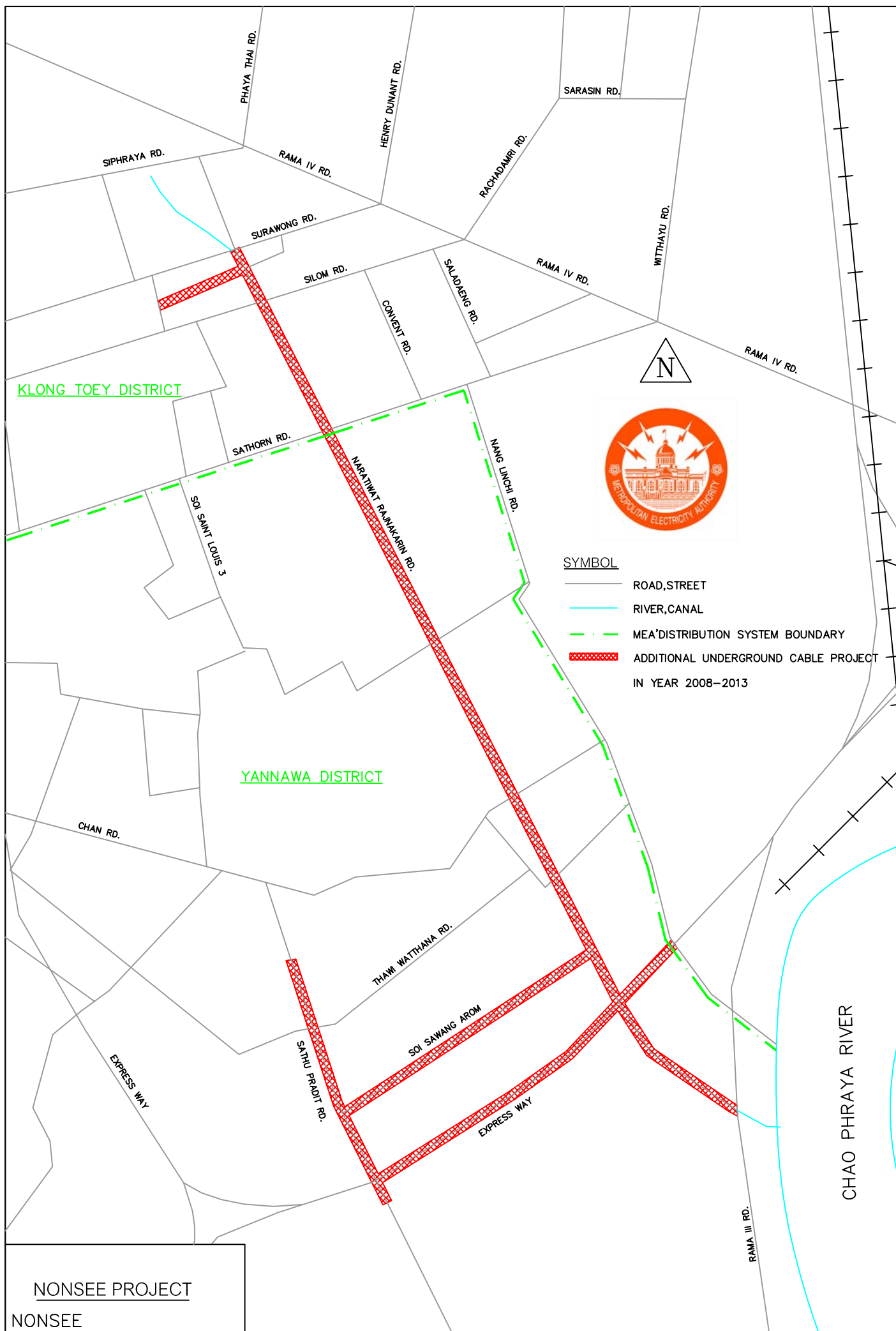


FIGURE 3-3 MAP OF TARGET AREA OF NONSEE PROJECT

Table 3-1 : Workload of the Replacement of Overhead Line by Underground Cable System Plan, FY 2008 - 2013

No.	Project	Distance (km)	Duct Bank (km)	Cable with accessories (circuit - km)	Retirement of OH line System (circuit - km)
1	Patumwan, Chitralada and Payatai Additional Project	6.0	6.1	21.6	9.3
2	Rama 3 Project	10.9	23.1	110.7	69.8
3	Nonsee Project	8.3	15.6	76.3	37.4
Total		25.2	44.8	208.6	116.5

4. Project Implementation

According to the project details, MEA will employ consultant to survey, prepare detailed design and bidding document for construction service and supervisory service of civil and electrical works.

In order to keep the implementation schedule be on time conforming to the target, the Projects will be contract out. However, the dismantling of overhead lines will be conducted by MEA workforce. The process of project implementation is shown in Table 4-1 or summarized as follows:

Implementation period during 2007 – 2013

- | | |
|-------------|---|
| 2007 – 2008 | Selection of consulting firm, in order to conduct the study, survey, prepare the detailed design and bidding document for the employment of construction and supervisory services |
| 2009 | Issuance of bidding document (construction of underground cable system) |
| 2010 – 2013 | Project implementation (construction, installation of equipment and dismantling of overhead lines) |

5. Investment Cost

The investment cost of the Replacement of Overhead Lines by Underground Cable System Plan, FY 2008 – 2013 consists of foreign currency portion for foreign materials and equipment; and local currency portion for tax of imported materials and equipment, local equipment, construction and installation cost and overhead charge. The current price is calculated from FY 2006 base price (exchange rate of USD 1: Baht 37.00 and EUR 1: Baht 48.306) plus 5% contingencies. The escalation factor is 3.0 per annum.

The total investment cost of the Plan is Baht 5,699.30 million of which Baht 2,562.56 million or 44.96% is in foreign currency, and Baht 3,136.74 million or 55.04% is in local currency. Interest during construction of Baht 382.07 million has already been included.

The investment cost is tabulated in Table 5-1 by project and Table 5-2 by sources of funds.

Table 4-1: Implementation Schedule of the Replacement of Overhead Line by Underground Cable System Plan, FY 2008 - 2013

ID	Task Name	Duration	2007	2008	2009	2010	2011	2012	2013	2014		
1	Underground Project	347.8 wks	[Gantt bar spanning from 2007 to 2014]									
2	1. Consulting Service (Conceptual Design)	121.8 wks	[Gantt bar spanning from 2007 to 2014]									
3	1.1 T.O.R.	13 wks	[Gantt bar from 2007 to 2008]									
4	1.2 Tender Issuing and Opening	9 wks	[Gantt bar from 2007 to 2008]									
5	1.3 Tender Evaluation	13 wks	[Gantt bar from 2007 to 2008]									
6	1.4 Contract	4 wks	[Gantt bar from 2007 to 2008]									
7	1.5 1st Stage : Conceptual Design and Detail Design	35.4 wks	[Gantt bar from 2008 to 2009]									
8	1.6 2nd Stage : Complete Solicitation Documents and Budget Estimation	21.4 wks	[Gantt bar from 2008 to 2009]									
9	1.7 3rd Stage : Assisting MEA to Evaluation the Offers	9 wks	[Gantt bar from 2008 to 2009]									
10	2. Consulting Service (Construction Supervisory)	244 wks	[Gantt bar spanning from 2007 to 2014]									
11	2.1 Tender Issuing and Opening	13 wks	[Gantt bar from 2008 to 2009]									
12	2.2 Tender Evaluation	19 wks	[Gantt bar from 2008 to 2009]									
13	2.3 Contract	4 wks	[Gantt bar from 2008 to 2009]									
14	2.4 1st Stage : Approval for Drawing and other Documents	4.5 wks	[Gantt bar from 2008 to 2009]									
15	2.5 2nd Stage : Construction Supervisory	208 wks	[Gantt bar from 2008 to 2014]									
16	3. Construction	236 wks	[Gantt bar spanning from 2007 to 2014]									
17	3.1 Tender Issuing and Opening	13 wks	[Gantt bar from 2008 to 2009]									
18	3.2 Tender Evaluation	19 wks	[Gantt bar from 2008 to 2009]									
19	3.3 Contract	4 wks	[Gantt bar from 2008 to 2009]									
20	3.4 Construction and Installation	200 wks	[Gantt bar spanning from 2007 to 2014]									
21	3.4.1 Survey and Design	17 wks	[Gantt bar from 2008 to 2009]									
22	3.4.2 DB & MH & Foundation Construction	102 wks	[Gantt bar from 2008 to 2014]									
23	3.4.3 Cable Installation	73 wks	[Gantt bar from 2008 to 2014]									
24	3.4.4 Equipment Installation	73 wks	[Gantt bar from 2008 to 2014]									
25	3.4.5 HV Customer Conversion	64 wks	[Gantt bar from 2008 to 2014]									
26	3.4.6 LV Customer Conversion	64 wks	[Gantt bar from 2008 to 2014]									
27	3.4.7 Street Light and Telephone System Conversion	64 wks	[Gantt bar from 2008 to 2014]									
28	4. Remove Pole & hardware, MV & LV Overhead Line and Transformers	12 wks	[Gantt bar from 2013 to 2014]									

Table 5 – 1 : Investment Cost by Project

Project	Investment Cost (Baht Million)		
	FC	LC	Total
1. Patumwan, Chitralada and Payatai Additional Project	225.89	303.22	529.11
2. Rama 3 Project	1,489.79	1,404.90	2,894.69
3. Nonsee Project	846.88	1,046.55	1,893.43
Subtotal	2,562.56	2,754.67	5,317.23
Interest during Construction	-	382.07	382.07
Total	2,562.56	3,136.74	5,699.30

Table 5-2: Sources of Funds

Sources of Funds	Amount (Baht Million)	Percentage
Local loan in substitution for foreign loan	2,400.00	42.11
Local Loan	1,000.00	17.55
MEA own incomes	2,299.36	40.34
Total	5,699.30	100.00

6. Internal Rate of Return

The analysis of the return on investment under the Plan is considered on the Economic Internal Rate of Return (EIRR) and the Financial Internal Rate of Return (FIRR).

6.1 Assumptions

1) The Internal Rate of Return is calculated on energy sales, revenue from value of electrical assets disposal from overhead line system, revenue of varied portion of energy loss, operating cost, maintenance cost and outage cost as listed:

- Value of electrical assets disposal from overhead line system consists of distribution transformers and aluminum ingot, estimated at 2006 constant price.
- Overhead line system loss, calculated on the resistance of 185 sq.mm overhead line (0.2 Ohm/km/phase) and of 400 sq.mm underground cable (0.063 Ohm/km/phase)
- Operating and Maintenance expenses (for overhead line) are calculated at 3.6% of investment cost and underground cable is calculated at 1.4% of investment cost
- Outage duration for overhead line calculated on System Average Interruption Duration Index (SAIDI) in Project area, compared with underground cable system at 8.0 minute/customer/year (data from network area) and the outage cost will be based on the study of Energy Research Institute, Chulalongkorn University, which is estimated at 53.8 Baht/kWh.

2) Investment Cost :

- In case of EIRR : the investment cost is calculated based on the year 2006 constant price including contingencies but excluding import tax.
- In case of FIRR : the investment cost is calculated based on the current price including contingencies and import tax.

3) Cost of Capital :

- In case of EIRR : The interest rate of Government bond is 7.18%
- In case of FIRR : Weighted Average Cost of Capital (WACC) is 5.90%

4) Project life : 25 years

6.2 Results

The EIRR was equal to -5.87%. As for the FIRR, was equal to -7.35%.

7. Summary

MEA has set up 3 projects of the Replacement of Overhead Line by Underground Cable System Plan for FY 2008 – 2013, comprising Patumwan, Chitralada and Payatai Additional Project, Rama 3 Project and Nonsee Project. The objectives of the Project are to enhance nice landscape, to reinforce the system reliability and to cope with the increasing power demand. The quantity of work, target and investment cost of the Plan are summarized in Table 7-1.

Table 7-1: Quantity of Work, Target and Investment Cost of the Replacement of Overhead Line by Underground Cable System Plan, FY 2008 – 2013

Projects	Line Length (km)	Completion Year	Investment Cost (Baht Million)		
			FC	LC	Total
Patumwan, Chitralada and Payatai Additional Project	6.0	2013	225.89	303.22	529.11
Rama 3 Project	10.9	2013	1,489.79	1,404.90	2,894.69
Nonsee Project	8.3	2013	846.88	1,046.55	1,893.43
Subtotal	25.20	-	2,562.56	2,754.67	5,317.23
Interest during construction		-	-	382.07	382.07
Total Investment Cost			2,562.56	3,136.74	5,699.30

According to item 6.2, the Economic Internal Rate of Return (EIRR) and Financial Internal Rate of Return (FIRR) are less than Weighted Average Cost of Capital (WACC) which is 5.90%. However, the results are excluded the intangible benefits as follows:

1. It will increase safety of life and property, for example, reducing accidents caused by falling electricity poles, or torn overhead line caused by car crash or storm, etc.
2. As Bangkok is the center of business and tourism, the improvement of landscape scenery will make Bangkok a livable city. Moreover, it helps promoting investment and tourism and contributing to more revenue to Thailand respectively.
3. The clean and nice landscape will create the good image of Thailand.